Development of a Fishing Log for Use in Trawlers

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The paper describes the technical and operational features of a composite equipment for simultaneous measurement of 5 important parameters, warp load, boat speed, water temperature, water salinity and air temperature pertaining to the craft, gear and the environment. The equipment is designed for continuous measurement in small and medium crafts easily without disturbance to routine fishing operations. The system operated on 9V supply, is suitable for portable operations from one vessel to another. The compact electronic meter kept in the wheel-house displays the data one by one in engineering units.

The otter trawl system is the most sophisticated fishing gear system comprising of different hydro-dynamic components to accomplish a definite composite function. The perfection of the system needs detailed studies on the various independent components and their correlation. During the last few decades several wire and wireless telemetering instruments have been developed for measuring various parameters of the trawl system (De Boer, 1959; Crewe, 1964; Hamuro & Ishii, 1964; Nicholle, 1964; Sivadas, 1968, 1969 and 1970). Sivadas *et al.*, (1986) developed an instrument for monitoring 15 operational and environmental parameters of trawl system under water.

Warp load measurements are required in fishing trawlers for the safe and efficient operation of the under water trawl system. Any malfunctioning of the net such as improper mouth opening, torn off cod end or entangling of the net under water, results in sudden change in the warp tension either up or down. Ploughing of otter boards in mud will cause an increase in tension. Warp load meters are also useful in experimental fishing operations for proper selection of a trawl net for a boat or vice versa for the most efficient and economic operation. Carrothers (1968), Scharfe (1959 & 1970) and Sivadas (1970) have reported warp load meters where the load is applied fully across their hooks. Luez (1970), Nicholle (1964), Hamuro & Ishii (1964), Anon (1969) reported warp tension meters where the load is sensed partially and computed for the full load. There are warp load meters with permanent installations as reported by Drever & Ellis (1968 a & b).

Measurement of the speed and distance are needed in all types of vessels as a routine information. It has got additional utility in fishing vessels engaged in certain types of fishing operation such as purse-seining, midwater trawling etc for the effective control of vessel for catching the comparatively fast moving fish shoals. Further such instruments also help to asses the condition of the engine and the proper operation of the dynamic fishing gear under water. Sivadas *et al.* (1983) have developed 'electronic boat log' for the measurement of boat speed.

Temperature and salinity are two important parameters directly related to fishery hydrography. In the absence of remote operated insitu measurements, these measurements were done by collecting the water samples from the required depths. Modern electronic instruments permit on the spot measurements. A detailed evaluation of salinity, temperature and depth instrumentation is reported by Jack (1975). Sivadas (1978; 1981) has developed electronic instruments for measurement of temperature, salinity and depth of operation. The operation of instruments with sensors mounted on the net and its accessories are very difficult, especially where cable is needed for conveying signals. The present development reported is a simple system, accommodating some of the most important parameters for easy operation in small and large vessels.

Materials and Methods

Description

The instrument consists of transducers for sensing five important parameters of craft, gear and the marine environment, namely, warp load, boat speed, air temperature, water salinity and water temperature and an electronic display meter on board the vessel to display these parameters in proper engineering units, one by one as per the command of the operator. The electronic unit and sensors are connected independently by 2-core cables. Fig. 1 is a schematic diagram of the boat fitted with the various sensors. Fig. 2 is the photograph of the receiver and display unit.

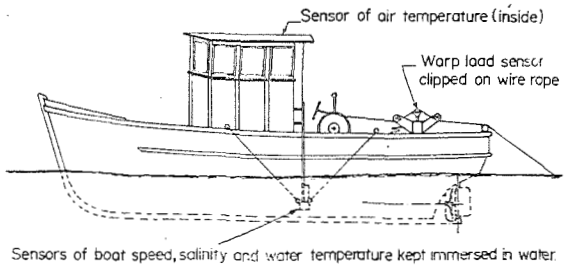

Fig. 1. Schematic diagram of boat fitted with five sensors

Warp load sensor

The transducer for warp load measurements consists of three pulleys and it is clipped on the wire rope whose tension is to be measured. In this condition the rope goes through the three pulleys and the transducer can hang on it without any other support. The pulley at the middle is pushed downwards to a maximum of 1 cm according to the tension. Now the tension 't' by which the spring is compressed down is related to the actual tension T as $t = 2T \sin \theta$, where θ is the deflection angle of the rope. The movement of the central pulley is converted to changes in the inductance of an electrical coil by means of a core moving inside it, supported by a piston mounted on a good quality spring. The changes in the inductance of the coil is communicated to the indicating meter through an ordinary 2-core wire.

Speed sensor

A conventional but much smaller savonius rotor with electric induction signal pick up has been developed for this purpose. This new technique has resulted in many operational and design advantages including small rotor, easy operation and two wire transmission.

Water salinity sensor

The transducer consists of a pair of platinum electrodes forming a conductivity cell whose conductivity is a function of salinity and temperature. The salinity is computed from conductivity and temperature.

Temperature sensor

Voltage developed across P–N junction of transistor is used to measure temperature. The element is encased in strong chamber for measurements in deeper waters. Two wire remote measurement, small size, suitability to hostile conditions and rough handling are special features of this sensor.

Fig. 2. Photograph of the receiver and display unit

Electronics

The electronics of the instrument consists of an oscillator producing sinusoidal voltage at 1000 Hz. These oscillations are buffer amplified and given to a Wheatstone's bridge network to energise the same. The sensors form one of the four arms of the bridge one by one as required and controlled by a multi switch as given in the block diagram in Fig. 3. The bridge output consists of the modulated signals with carrier from the oscillator and the intelligence from the transducers.

The outputs of the bridge are detected and filtered to produce steady D.C. proportional to the signals. These are fed to the inputs of an operational amplifier working in differential mode to eliminate errors due to ambient temperature changes, slight voltage changes of the power supply, frequency instability of the oscillator etc. The output of the opamp gives the information in D.C. voltage from 0 to 5V. This D.C. voltage is converted to the required information in engineering units by proper potential division and level shifting and displayed in a LCD panel meter one by one by means of multiway selector switch.

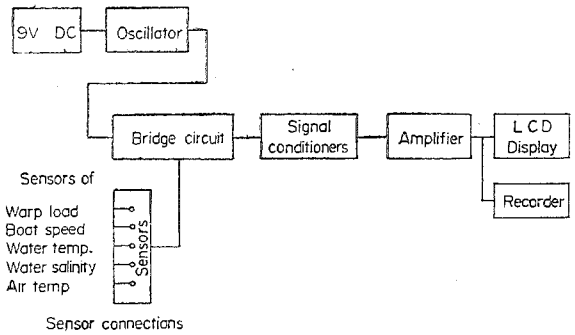

Fig. 3. Block diagram of fishing log

Specifications of ranges

Warp load	0 to 500 or 1000 or 5000 kg ± 1%
Boat speed	0 to 15 knots, ± 0.1 knot
Water temperature	10 to 40°C, ± 0.1°C
Water salinity	0 to 38 ppt, ± 0.1 ppt
Air temperature	0 to 50°C, ± 0.1°C
Display	Digital LCD display
Power	9V or 12V battery with current consumption less than 70 mA

Results and Discussion

The sensors were designed for operation in hostile sea condition. The instrument works on 9V self contained dry cells or 12V external supply from the boat. The current consumption is less than 70 mA. The instrument is developed fully out of indigenous materials. The sensors and the complete system have been operated in different combinations in small and large vessels.

Since all the sensors are mounted on different parts of the boat, their handling and operation are comparatively easier and the skipper of the vessel can do it conveniently. There are two types of sensors for warp load measurements namely, portable type and ship-installed type. While portable type with shorter ranges of 500 kg and 1000 kg can be used in smaller trawlers, measurements in larger vessels can be done using ship-installed type which has got high flexibility in the selection of ranges. Both sensors can be installed and measurements be taken without disturbing fishing operations.

While all other data are displayed directly in their units, salinity readings have to be corrected for temperature variations manually using the calibration chart. The instrument can be used as a portable one in small and large vessels and it can be used for regular marine environmental survey for salinity and temperature using any type of craft.

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References

Anon (1969) *World Fishing,* 18 (2), 50

Carrothers, P. J. C. (1968) *Fish. Res. Bd Can. Bulletin,* 163

Crewe (1964) in *Modern Fishing Gear of the World* (Kristjonsson, H., Ed.) Vol. 2, p. 165, Fishing News (Books) Ltd., London

De Boer, P. A. (1959) in *Modern Fishing Gear of the World* (Kristjonsson, H., Ed.) Vol. 1, p. 225, Fishing News (Books) Ltd., London

Drever, C. & Ellis, J. (1968a) *World. Fishing* 17 (11), 34

Drever, C. & Ellis, J. (1968b) *World. Fishiug* 17 (12), 26

Hamuro, C. & Ishii, K. (1964) in *Moderm Fishing Gear of the World* (Kristjonsson, H., Ed.) Vol. 2, p. 513, Fishing News (Books) Ltd., London

Jack, E. Jager (1975) *Sea Technology,* 76 (6), 18

Luez, L. D. (1970) in *Modern Fishing Gear of the World* (Kristjonsson, H., Ed.) Vol. 3, p. 384, Fishing News (Books) Ltd., London

Nicholle (1964) in *Modern Fishing Gear of the World,* (Kristjonsson, H., Ed.) Vol., 2, p. 297, Fishing News (Books) Ltd., London

Scharfe, J. (1959) in *Modern Fishing Gear of the World,* (Kristjonsson, H., Ed.) Vol. 1, p. 497, Fishing News (Books), Ltd., London

Scharfe, J. (1970) *Proc. Conf. autom. mech. fishing ind.* Montreal, Canada, 222

Sivadas, T. K. (1968) *Res. Ind.* 13, 89

Sivadas, T. K. (1969) *Res. Ind.* 14, 122

Sivadas, T. K. (1970) *Fish. Technol.* 7, 48

Sivadas, T. K. (1978) *Fish. Technol.* 19, 77

Sivadas, T. K. (1981) *Proceedings of the First Indian Conference in Ocean Engineering,* Vol. VII, 53

Sivadas, T. K., Ramakrishnan, K. & Vijayabharathi, K. (1983) *Proeeedings of Second Indian Conference in Ocean Engineering*, No. VI–4, p. 951

Sivadas, T. K., Ramakrishnan, K. & Vijayabharathi,K. (1986) *Proceedings of the International Seminar on Training and Education for Marine Fisheries Management and Development,* p. 57